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ADDRESS OF WELCOME BY PRESIDENT  
ANGELL.

*Ladies and Gentlemen:* I am glad to know that I can properly use this familiar style of address. For I see before me several ladies who have by their learning fairly earned their place in this society of scientists.

In the name of the regents and the faculties of the university I extend to you all a hearty welcome to our halls. We thank you that you have done us the honor to choose this as your place of meeting. We are proud to see under our roof so many eminent representatives of colleges, universities and learned societies, so many who have by careful study and investigation done much to enlarge the boundaries of human knowledge.

Perhaps you will permit me as your senior to say that when I look back to my college days—now nearly three score years in the past—nothing is more striking to me than the change which has been wrought in the attitude and methods of the teachers of science in our schools of higher learning.

In my student days in the curriculum of the best colleges a very brief period, from six to twelve weeks, was given to any science. The instruction consisted mainly in compelling students to memorize text-books. A few illustrative lectures with experiments performed by the professor were sometimes given, which often instructed us by their failure rather than by their success. Laboratories there were none in any institution. The professors who made any original investigation or who betrayed any knowledge much beyond the range of the text-books were not numerous. From such teaching not much inspiration could be expected.

One of the first men to startle us and inspire us by the revelation of new methods was Louis Agassiz. He accomplished this not alone by his training of pupils at Cam-

bridge and Penikese, but by his popular lectures. As I recall some of these I feel again kindling within me the glow of enthusiasm with which we listened to him, as with his winsome French accent he told us of the development of animal life, and with his skilful and rapid drawing he made a fish fairly flop out of the blackboard. His enthusiasm for research was contagious and soon we had votaries of all the sciences questioning nature at a hundred points.

From those days progress was rapid. And so now the spirit of research is dominant among all scientific men. The perfunctory and mechanical teachers have largely disappeared, and happily the present generation of students are taught to observe, to investigate, to make careful inductions and to work in the true scientific spirit.

We are glad to meet you as you come to us from your laboratories and various fields of research, your faces aglow with the enthusiasm of investigators and discoverers, to whom nature has been compelled to yield up some of her choicest secrets. Your presence and companionship will stir us with a new passion for truth, and when you depart, we shall feel that the priests of science have dwelt under our roof-tree and left a blessing on the gates of our dwelling.

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SOME ASPECTS OF THE ENDOWMENT OF  
RESEARCH.<sup>1</sup>

IN the days of ancient Rome the returning conqueror borne on his triumphal car must listen to a slave who bade him to remember some joy-dispelling facts.

After the lapse of many centuries the Naturalists, oddly enough, revived this pagan ceremony. By them each year a slave is chosen who, at the next season of

<sup>1</sup>Address at the meeting of the Society of American Naturalists at Ann Arbor, December 28, 1905, by Henry H. Donaldson, chairman of the Central Branch.

their triumph, is permitted to make a few remarks intended to hold down to earth those who are leading the procession.

It is a good custom, but wearing on the slave. One experience generally does for him. Yet, his privilege implies an obligation and in pursuance of this obligation, which our usage thus imposes, I have chosen for my theme 'Some Aspects of the Endowment of Research.'

The questions which this topic conjures into life have lately pressed themselves on my attention, and it appears that the only way to put them decently at rest is to sentence them to death—in an address—and then allow them to be buried—in the records of our learned society.

The events which have brought the endowment of research into special notice during the last decade are known to all. As examples of the thing I have in mind, let me cite the Carnegie Institution, the Rockefeller Institute and the Nobel prizes.

Such notable foundations have claimed our attention because they were recent, involved great sums of money and closely touched our interests as working naturalists.

But we should view them in their historical relation in order to appreciate their broader significance, and when this is done it will be plain, I think, that their novelty depends most largely on the fact that in a measure they can be devoted to the aid of biological investigation.

Even in our own young country such foundations are by no means new. Our academies and learned societies have long had funds for the encouragement of investigation. To be sure, these have been mainly applied to the domain of the physical sciences—a fact which needs no explanation when we recall that the physical sciences were the first to be pushed forward by the wave of modern interest.

Nevertheless, such foundations as the

Smithsonian Institution and the Elizabeth Thompson Fund have for many years contributed to biological progress. Inadequate as these provisions are to meet what we may courteously call the reasonable wants of workers in this field, they serve to show that, here and there, an individual has recognized the need of larger resources for scientific work, and has sought to supply them. When we look across the water, we find provisions of this sort to be an old story to the older world.

Throughout Great Britain and the continent, academies and societies for generations have had at their disposal no inconsiderable sums of money—indeed, in many instances, far greater sums than we are wont to imagine.

The expenditure of these moneys has been mainly for work outside the natural sciences, but even within this latter group biological work has had the lesser share. This is said in no spirit of complaint, but merely to suggest why this condition of affairs in the scientific world at large is so rarely forced on our attention.

But there are still other ways in which the expenses of scientific work have been defrayed. States and nations, as well as individuals, have been contributors. The former have expended really great sums on the various branches of science in the conduct of surveys, commissions, bureaus, observatories and expeditions. The movement has been coextensive with the civilized world, and the outlay much greater than that for the corresponding scientific work in institutions of higher learning. On this topic it is not necessary to enlarge, but I will only add that the work accomplished has been enormous and without state aid would have been well-nigh impossible.

It is plain, however, that we should distinguish in a general way between governmental science work supported from the public funds and the other kinds, repre-

sented by university science and that which has developed under the special endowments for research, for the responsibilities of the investigation are often very different in the two cases. But these distinctions need not be elaborated, and are here noted merely for the sake of clearness later on.

My point is made, if by these remarks your attention is directed to the fact that the endowments, which to-day are to us best known, stand merely as the latest in a long list of gifts left with the hope of aiding the advance in knowledge, and if these bequests of the last few years are in any way peculiar, they are chiefly so by the reason of the generosity of the donors and the arrangement of the donations to include biology.

Yet, if we take the broadest view of the situation, as represented by the scientific returns, it appears that it is within the universities that the more advanced and fundamental scientific work has been accomplished.

It is possible that this last remark will not command unqualified assent; and yet when the smoke of argument has cleared away it will, I think, remain essentially unmodified. But in reaching your conclusions, I beg you to remember that in an address like this it is necessary to speak broadly and to trust that one will be generously understood.

To present rightly the reasons for university productiveness, it will be needful first to say a word concerning the normal progress of scientific interest and also to make a little more precise the idea of research.

As this company is well aware, interest in any scientific field passes through a regular series of progressive phases. Attention and effort are first concentrated on the collection and classification of the material. This constitutes what may be termed the systematic phase. But only

after this portion of the task has been in some measure accomplished, can comparison and experimentation be undertaken as a basis for inductions which shall yield new knowledge and enlarge our philosophic view.

It is the sort of work that characterizes this second phase of our advancing interest which is best designated by the term research, and in this paper we use the word in such a sense.

It is contended then that the universities furnish the conditions in which research grows best—and if true, this fact is worthy of examination.

Broadly speaking, the effect of these favorable conditions is best seen in the mental attitude of the investigator towards his work. The men of the universities have been freer than any other group to follow the leadings of their own investigations, and to solve the next problem which logically confronted them, or, at least, to spend their time, mayhap their lives, and not infrequently their patrimony, in seeking a solution.

It is true, however, that such scientific freedom does not by any means always exist where work in science is in progress. Sometimes, in the case of the endowments intended for research, and much more often in the case of scientific work dependent upon the public funds, the expenditures have been applied for assigned work where the plan or program ran even into petty details; statements of progress or reports of activity being expected or demanded.

Unfortunately research can not be thus assigned, because there is nothing to assign. The investigator, like an adventurous explorer, thinks 'the country to the west looks interesting' and he makes a start. It may be years before we hear from him again, and no man can justly predict success or failure. We do not ask of such a man

that he should first draw a map of the unknown region, or engage to see that those who sent him are kept regularly informed. His energies and time belong to other work.

In many fields the hard, laborious initial work has been so largely done that the second phase of interest is the one before us and we must cast about for the best and surest way to meet the problems which are thus presented. If these have had their best solution thus far in the universities, let us look that way for our enlightenment.

It is safe to assume that this company knows the drawbacks—some of them at least—which inhere in university life, but with your consent that topic may be put aside. On the other hand, the advantages should be briefly stated. They are these—immediate association with productive colleagues; the vitalizing contact of the stream of youth; no responsibility save to the high court of one's fellow workers; no assignments or programs imposed from without, but full liberty to follow where the research leads—time not being 'of the essence of the contract.'

These are conditions which make for intellectual growth and accomplishment; these are the conditions which in the university surround the research worker, and these are the conditions which the effective endowment of research should struggle to preserve.

If such views are sound, then isolation—the kind that withdraws a worker from his colleagues and the stream of youth—is to be looked on with suspicion. There may be moments when the investigator, finding his days broken into little bits and his energies dissipated by irrelevant and trivial affairs, is fascinated by an opportunity which hints at isolation and promises relief, forgetting that, if to escape the ills he also sacrifices the advantages of his university surroundings, he has put himself in a position where

few men hold their own. Lady Dilke describes it thus:

The man who for any cause utterly forsakes the paths of his fellow-men is by them given up, as lost, and becomes as one of no account—being reckoned a dreamer of idle dreams.

Therefore let him beware who hears that call—be it ever so alluring—which bids a man separate himself from his company, lest in the following after its strange music he should become a cast-away.

But among the other features of the academic world which endowment should preserve, and perhaps the most important, is freedom from the limitations which naturally follow from assignment. The matter here is passing delicate.

It so happens that even investigators have failings—more or less human—and these must be considered. If it pleases us to imagine that our prototypes in the by-gone days were the voyagers and adventurers of the Renaissance, let us take a sample of their point of view. Columbus, just anchored off the western isles, writes to his royal patron on the morning of that first Sunday that 'he and those with him have come thither to bring the light to them that sit in darkness and slake the thirst for gold which all men feel.' To-day we do not say it so naively, but yet we know how Columbus felt. It is this unfortunate combination of two powerful desires in the investigator's heart which causes trouble. How can such complex beings be made to bend all their energies to 'bringing light,' and at the same time be induced to properly neglect their 'thirst.' This is the problem which confronts those who are responsible for the wise management of research funds. There have been times when it was felt that assignments and limitations calling, as it were, for so much light per hour would accomplish the result. But any such device is contrary to the very spirit of research. What then, you ask?

Simply that when in the course of events an investigator is given great opportunities, it should be assumed that he is a heaven-born Lucifer, and will act accordingly. Should he prove unequal to the trust reposed, and his ways be ways of darkness—not of light—another must be entered in his place, but a truce to half-way measures. Research with a string to it suffers too many drawbacks.

Yet, even with freedom and right intellectual surroundings, we as investigators can hardly lay too much emphasis on the frame of mind in which we approach the problems that confront us. By our common methods, and even by our metaphors, we too often seem to advance upon the undiscovered country as though the chief desire were to reclaim it anyhow and any way, so that it were done rapidly and before others could arrive. This is a notion borrowed from the creed of economics, but it does not fit research. The endowment of research can foster more than this. Just as the frontier is not only the locality of active advance, but also the place where strong frontiersmen grow, so the chief gain coming from those stationed on the boundaries of science is not the mere reclamation of the wilderness, but far more, the improvement of the scientific breed, for as we advance the problems become rapidly more difficult, and it is only the abler men who can push on the work. For us then it becomes a privilege, if not a duty, to so work together that in this country the endowment of research shall be adjusted to preserve the intellectual stimulus and the scientific freedom which the universities afford, while it removes some of the drawbacks 'thereunto appertaining,' and so administered that in stimulating scientific activity, it shall do this not only and not mainly for the sake of immediate returns, but also, and even more, for the sake of the effect which the experience must have on

those who do the work—aiming to develop the better man to meet the greater problem.

HENRY H. DONALDSON.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION E—GEOLOGY AND GEOGRAPHY.<sup>1</sup>

THE section was called to order by Professor Eugene A. Smith, retiring vice-president, who introduced and resigned the chair to his successor, Professor William North Rice. On motion Professor L. C. Glenn, of Vanderbilt University, was elected secretary *pro tem.* in the absence of the regular secretary of the section, E. O. Hovey. President C. R. Van Hise was elected a member of the council, Professor E. H. Barbour a member of the general committee and Professor L. C. Glenn press secretary. Fifty-nine members of the association were recommended for promotion to fellowship, forty of them on the basis of their membership in societies of high technical standing.

The address of the retiring Vice-president, Professor Eugene A. Smith, was on the subject 'On some Post-Eocene and Other Formations of the Gulf Region of the United States,' and will be printed in full in SCIENCE. Eleven other papers were upon the program, six of which were read in full by their authors. The other five were read in abstract or in full by the secretary *pro tem.* in the absence of their authors. Abstracts of all the papers read follow:

*On the Use of the Words Synclinalorium and Anticlinorium:* WILLIAM NORTH RICE.

A technical term once introduced should be retained in the original sense. If in the progress of thought the concept which a word expresses ceases to be useful, the word may become obsolete, but should not be used to express a totally different idea.

<sup>1</sup> New Orleans meeting.